

REVISION OF THE NORTH AMERICAN SPECIES OF TEPHROSIA.

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WHILE the greater part of the difficulties of the genus *Tephrosia* lie, happily, beyond the geographical limits of the North American flora, yet the dozen species which inhabit sandy regions in our southern states are sufficiently variable in their foliage and similar in their floral and carpological structure to lead to diverse views on their specific limits and proper arrangement. Miss Vail's recent monograph¹ of these species, although abounding in long and detailed descriptions, fails to bring out clearly the primary divisions of the genus. The introductory synopsis—which, although arranged in perfect accord with the natural sequence of the species in the paper, is styled an “artificial key”—is based chiefly upon the length and density of the inflorescence, features which are too variable and confluent to furnish diagnostic characters of the first rank. It seems to the writer that the sympodial and monopodial structure of the stem offers a difference much more evident and, indeed, sufficiently fundamental to divide our species at once into two well-marked sections. After this first division the size of the flowers, density of the inflorescence, and nature of the foliage may be employed with greater diagnostic effect.

In the limitation of species it is believed that Miss Vail's *Cracca floridana* is only separated artificially from her *C. Smallii*. The distinctions adduced are chiefly the “truly prostrate” habit of the former species, and its narrower, more numerous leaflets. As to the breadth of the leaflets, this is (according to Miss Vail) 6 to 14^{mm} in *C. Smallii*, and 5 to 12^{mm} in *C. floridana*, surely no very striking difference. In number the leaflets are said to vary in *C. Smallii* from 3 to 11, while in Mr. Nash's

¹ A revision of the North American species of the genus *Cracca*. Bull. Torr. Bot. Club 22: 25-36. (1899)

authenticated specimens of *C. floridana* they vary from 7 to 13, and had these specimens been younger, it is safe to surmise, leaves with fewer leaflets would have been found, an inference amply supported by the development in related species. Regarding the supposed assurgent habit of *C. Smallii* (a species not only distinguished in the field, but called to scientific notice by Mr. A. H. Curtiss), it may be said that the main stems bear evidence of being prostrate except near the tip. This is shown not only by the curvature and position of the leaves and peduncles, but by the almost constant presence of clinging particles of sand which adhere, even in the type specimens, to the lower surface of the stem, and are lacking upon the upper surface. This position of the stem is fully confirmed by field notes kindly furnished by Mr. Curtiss. The assurgent character is, therefore, confined to the leaves (which are said to be somewhat ascending but less erect than in *T. ambigua*), the peduncles, and the growing tips of the stems. On the other hand, specimens of *C. floridana*, although said to have prostrate stems and leaves, give by no means the impression of a closely prostrate plant, an idea which is at once conveyed by specimens of *T. chrysophylla*. In the absence of more telling morphological features the two species *C. floridana* and *C. Smallii* are here united.

Miss Vail is certainly in error in interpreting Shuttleworth's *T. angustissima*, her characterization evidently being drawn from Mr. Curtiss' plants so named. Shuttleworth's type, collected on the Miami river by Rugel, is in the Gray herbarium, and is clearly a linear-leaved form of *T. purpurea* Pers., with which it shares the characteristic small flowers, of which one or two are axillary, and the rest borne in a very slender raceme. On the other hand Curtiss' nos. 584 and 5708, just mentioned, appear to be nothing but smoothish narrow-leaved *T. ambigua*, not differing by a single morphological character of specific value. In her key (p. 26), Miss Vail distinguishes this plant (her *Cracca angustissima*) from *T. ambigua* on the ground that it is *erect*, and has linear leaflets, but in her description (p. 32) it is characterized as *prostrate*.

T. Rugelii Shuttleworth is an interesting and hitherto undescribed species possessing the stem-structure of § BRISSONIA but the habit and foliage of *T. chrysophylla*, which is of § REINERIA.

T. tenella Gray seems to have been founded upon a juvenile state of *T. purpurea*, to which (under the name of *T. leptostachya* DC.) it was reduced by Bentham in Mart. Fl. Bras. 15¹: 48. *T. purpurea*, however, is highly variable, at least in foliage, and certainly merits further study with more copious material than is now available.

The writer is grateful to Drs. Britton and Small for the loan of the larger part of the North American Tephrosias from the herbarium of the New York Botanical Garden. These have been of material assistance in the present revision.

As the genus is here interpreted in its generally accepted significance, it is useless to take space for a generic description.

Besides the species here described, the tropical *T. cinerea* Pers. has been found in the southern states, but only on ballast ground (Alabama, Dr. C. Mohr). It is of the § REINERIA, and has rather numerous narrowly oblanceolate-linear leaflets, which are hoary-pubescent upon both surfaces.

§ 1. BRISSONIA DC. Stem monopodial: racemes terminal or axillary, never opposite the leaves: flowers (in our species) large, with petals 1 to 1.7^{cm} long.—Prodr. 2: 249, in part; Taubert in Engl. & Prantl, Pflanzenf. 3: Ab. 3. 269. *Brissonia* Necker, Elem. 3: 36.

* Pods glabrous at maturity: racemes loose: southwestern.

T. LEIOCARPA Gray. Undershrub, cinereous with fine appressed pubescence: stems several, 4 to 6^{dm} high, suberect: leaves petiolate, 15-19-foliolate; leaflets narrowly oblong, 1.6 to 3.2^{cm} in length: racemes both terminal and axillary: pods 5 to 5.7^{cm} long, about 10-seeded.—Pl. Wright. 2: 36; Walp. Ann. 4: 489. *Cracca leiocarpa* Kuntze, Rev. Gen. 1: 175; Vail, Bull. Torr. Club 22: 28 (where type locality is erroneously stated to be New Mexico).—Sonoita valley, close to the southern boundary of

Arizona, *Wright*, no. 965, *Rothrock*, no. 685. (Northern Mexico.)

* * Pods permanently pubescent or puberulent: inflorescence short and dense.

+ Calyx-lobes ovate-lanceolate to lanceolate: pubescence gray: petioles rarely 6^{mm} in length.

T. VIRGINIANA Pers. (GOAT'S RUE.) Stems several, 3 to 4.5^{dm} high, erect from a stout knotted lignescent root: pubescence fine, soft, somewhat variable in quantity, often copious toward the summit: leaflets 11 to 23, oblong to elliptical, green and scarcely pubescent above, somewhat paler and soft villous beneath, 2.5 to 3.2^{cm} long; petioles very short; stipules caducous: flowers borne partly in pairs or singly in the upper axils but chiefly in a short dense raceme little raised above the surrounding leaves: calyx hairy, the teeth caudate-acuminate: petals white or pale yellow with purplish tinge: hirsute pods soon spreading or divaricate.—Syn. 2: 329; Pursh, Fl. 2: 489; Ell. Sk. 2: 245; Torr. & Gray, Fl. 1: 295; Wats. & Coulter in Gray, Man. ed. 6, 133; Meehan, Nat. Fl. 1: 81. *pl.* 21. *T. virginica* Bigel. Fl. Bost. ed. 3, 296. *Galega virginica* L. Spec. ed. 2, 2: 1062; Hill. Veg. Syst. 21. *pl.* 55, *f.* 1. *Cracca virginiana* L. Spec. 2: 752; Vail, l. c. 27.—Dry open woods especially in sandy soil, common; New England to the north shore of Lake Erie, thence to Texas and Florida; fl. May, June; fr. July to September.

Var. *HOLOSERICEA* Torr. & Gray. Leaflets inclining to be narrow and acute; pubescence more copious, long and silky or even woolly on the pods.—Fl. 1: 296. *T. holosericea* Nutt. Jour. Acad. Philad. 7: 105. *Cracca virginiana* var. *holosericea* Vail, l. c.—Arkansas, *Nuttall*, *Marcy Exp.*, and Texas, *Hall*. Similar but less marked forms in Wisconsin and W. New York.

+ + Calyx-lobes very narrow, almost filiform: pubescence tawny.

++ Petioles 1.7 to 4.2^{cm} long: leaflets oblong: southwestern.

T. LEUCANTHA HBK. Erect, branched from a lignescent base: leaflets 15 to 20, oblong, appressed-villous on both surfaces, nearly concolorous, 1.9 to 3.2^{cm} long: racemes capitate, pedunculate, chiefly terminal; linear filiform bracts considerably exceeding the buds: petals white with or without a purple tinge: pods

narrow, 5 to 6.2^{cm} long, soon divaricate.—Nov. Gen. & Spec. 6: 460. *pl.* 577; Gray, Pl. Wright. 2: 36; Torr. Bot. Mex. Bound. 51. *Cracca leucantha* Kuntze, l. c.; Vail, l. c.—Mountainous regions in S. Arizona, *Rothrock*, *Lemmon*, *Pringle*. (Mex. where first collected by *Humboldt & Bonpland*.)

++ ++ Petioles 4 to 17^{mm} long: leaflets obovate: Florida.

**T. Rugelii* SHUTTLEWORTH in herb. Stems several, decumbent or suberect from a lignescent stock, finely appressed-pubescent with bronze-colored hairs: leaves 3-11-foliolate; stipules persistent, 4 to 6^{mm} long; leaflets obovate, retuse, mucronulate, finely appressed-pubescent and yellowish-green above, decidedly paler, cinereous and very veiny beneath, 8 to 17^{mm} long, half as broad: flowers borne chiefly in pairs in the upper axils or forming a subcapitate raceme at the summit of the stem: calyx tawny-villous, 5^{mm} long, its narrow teeth subequal: petals probably purple: pods somewhat falcate, 3.8^{cm} long, 5^{mm} broad, tomentulose.—In pine woods on the Manatee river, S.W. Florida, *Rugel*, no. 156, June 1845. Type in herb. Gray. A characteristic and, according to our present knowledge, thoroughly distinct species with the habit of *T. chrysophylla*, from which it differs in its monopodial stem and axillary flowers, as well as in the presence of pubescence upon the upper surface of the leaves.

§2. REINERIA DC. l. c. 251, in part. Stem sympodial, the main axis at one or more nodes terminating in a raceme which by the strong development of an axillary bud at its base becomes apparently lateral: some of the racemes thus appear to arise opposite the leaves. (The sympodial structure is tardily developed in *T. purpurea*, which during its first season sometimes produces only a terminal raceme. This species, however, may be readily distinguished from those of the preceding section by its smaller flowers, which are only 6 to 8.5^{mm} long.)—*Reineria* Moench, Meth. Suppl. 44.

* Flowers large: petals 1 to 1.7^{cm} long.

+ Leaflets (with rare exceptions) exceeding the short petioles.

+ + Flowers not numerous, borne singly or in pairs at the nodes of the racemes.

= Stem covered at least below with a short dense bronze-colored tomentum: leaflets thickish, of firm or subcoriaceous texture, glabrous and finely reticulated above.

a. Leaves prostrate, essentially sessile; leaflets seldom more than 7.

T. CHRYSOPHYLLA Pursh. Perennial herb with spreading prostrate freely branched somewhat flexuous or geniculate stems, subsessile, 2-7-foliate leaves, and obovate leaflets (1.3 to 3^{cm} long): few-flowered racemes opposite the leaves; peduncles scarcely ancipital, 5 to 8.8^{cm} long: petals white, changing to red: pubescence on the lower surface of the leaflets dense, sericeous, somewhat canescent but with a slight golden sheen: pods 3.4 to 4.2^{cm} long, 8-10-seeded.—Fl. 2: 489; Ell. Sk. 2: 246; Torr. & Gray, Fl. 1: 297; Chapm. Fl. 95. *T. prostrata* Nutt. Gen. 2: 120. *Cracca chrysophylla* Kuntze, l. c. 174; Vail, l. c. 34.—Dry pine woods, Georgia, *Boykin, Forbes*, to Florida, where apparently common, "and westward" acc. to Chapman, but probably in reference to *T. Smallii*.

—[✓]Var. **Chapmanni**. Plant smaller, leaflets 6 to 13^{mm} long, half as broad: pods only 1.9^{cm} long, 5-8-seeded.—*Cracca chrysophylla* var. *Chapmanni* Vail, l. c.—St. Josephs, Florida, *Dr. Chapman*.

b. Leaves, at least in some cases, ascending, petiolate; leaflets mostly 7 to 11.

— **T. Smallii**, n. comb.—Similar to the preceding species in many ways, but stouter, with more numerous and longer (oblong or elliptic rather than obovate) leaflets: peduncles decidedly ancipital above, becoming 5 to 20^{cm} in length.—*Cracca intermedia* Small, Bull. Torr. Club. 21: 303. *C. Smallii* and *C. floridana* Vail, l. c. 33, 35.—Pine barrens in sand, Georgia, *Boykin*, to Florida, *Curtiss, Nash*, and Louisiana, *Dr. Ingalls*. The previous use of *intermedia* in *Tephrosia* necessitates the adoption of the second specific name.

= = Stems very slender, sparingly pubescent: leaflets rather small, elliptical, thin.

T. HISPIDULA Pers. l. c. Stems several, branched, spreading and ascending from a thickish somewhat fusiform root, finely

pubescent or glabrate; hairs sometimes spreading but usually appressed: leaflets 11 to 17, elliptic-oblong to linear-lanceolate, thinnish, usually deflexed, appressed-pubescent or glabrous above, slightly paler appressed-villous beneath, usually rounded and mucronulate at the apex: petals at maturity purple, sometimes 1.6^{cm} in length: pods 8-10 seeded, covered with short appressed or more often spreading hairs.—Pursh, Fl. 2: 489; Ell. Sk. 2: 245; Torr. & Gray, Fl. 1: 296, excl. vars.; Chapm. Fl. 95. *T. gracilis* Nutt. Gen. 2: 119. 1818. *T. elegans* Nutt. Jour. Acad. Philad. 7: 105. *Galega hispidula* Michx. Fl. 2: 68. *Cracca hispidula* Kuntze, l. c. 175; Vail, l. c. 33.—Sandy barrens, Virginia and N. Carolina, Curtis, to Florida and Louisiana, Hale.

= = = Stems rather stout, covered with a copious coarse tawny spreading pubescence; leaflets sparingly villous along the midnerve above or appressed-pubescent over the entire upper surface.

T. VILLOSA Pers. l. c. ¹ Stem 3 to 9^{dm} long, sprawling, tawny-hirsute: leaflets 3 to 17, elliptic or obovate, rounded and apiculate at the end, villous beneath, more or less appressed-pubescent also on the upper surface, about 2.5^{cm} long, a third to half as broad; rhachis tawny-pubescent: peduncles long, somewhat ancipital; interrupted few-flowered raceme surpassing the leaves: calyx lobes with long filiform tips: petals pale or more often (at least in age) purple red.—*T. spicata* Torr. & Gray, Fl. 1: 296; Chapm. Fl. 95; Wats. & Coulter in Gray, Man. ed. 6, 133. *T.*

¹This species was originally described by Michaux (1803) as *Galega villosa*, with a range "a Carolina ad Floridam." There is absolutely no evidence that Michaux regarded his plant as the equivalent of the Asiatic *G. villosa* L. The name *Tephrosia villosa* is first employed by Persoon in his Synopsis (1807) and is there used exclusively for the American plant. This is shown not only by the identical range but by the quoted character, which is taken bodily from Michaux's work. The usage of DeCandolle and many more recent European writers, by which the name *T. villosa* Pers. is applied to an East Indian and African species, to which Persoon's description had no reference whatever, is clearly an unwarrantable transposition. It is true that there was an earlier *Galega villosa* than that of Michaux, but this should not invalidate *Tephrosia villosa* Pers., which is clearly applied to the American plant and antedated by no homonym. The plant of the Old World, although possessing an earlier specific name, was not brought under *Tephrosia* until later and, it is believed, should in that genus receive another specific designation.

paucifolia Nutt. Gen. 2: 119. ? *T. hispida* DC. Prodr. 2: 250. *T. mollissima* Bertol. Bot. Miscel. 9: 10. pl. 3. f. 2, and Bot. Zeit. 9: 902, acc. to Gray. *Galega spicata* Walt. Car. 188. *G. villosa* Michx. Fl. 2: 67. *G. paucifolia* M. A. Curtis, Jour. Bost. Nat. Hist. Soc. 1: 122. ? *Crafordia bractiata* Raf. Specch. 1: 156. *Cracca spicata* Kuntze, l. c.; Vail, l. c. 30.—Dry sandy ground, common, Delaware to Florida, west to Arkansas (acc. to Lesquereux) and Louisiana, *Hale*; fl. May to July.

— Var. **flexuosa**. Leaflets linear to lance-linear, acute, the terminal one much elongated.—*T. flexuosa* Chapm. acc. to Torr. & Gray, l. c. 297, in synonym. *T. hispidula* var. γ Torr. & Gray, l. c. *Cracca spicata* var. *flexuosa* A. M. Vail, l. c.—Florida, *Chapman*; poorly known and perhaps distinct. A similar but nearly glabrous form has been found in Alabama by *Gates*.

++ ++ Flowers numerous, the middle ones borne in threes and fours: leaflets also numerous, 9 to 27, linear-oblong, 2.5 to 3.8^{cm} in length.

T. ONOBRYCHOIDES Nutt. Rather stout for the genus, erect or nearly so: stem terete, geniculate, producing from near the summit a long-peduncled erect many-flowered raceme: leaflets oblong, silky beneath, obtuse or retuse at the apex, cuneate at the base, 2.5 to 3.8^{cm} long, a fourth as wide: flowers pale changing to red or at length purple: pods secund, finely appressed-pubescent.—Jour. Acad. Philad. 7: 104; Torr. & Gray, Fl. 1: 296; Engelm. & Gray, Pl. Lindh. 1: 6, 33; Gray in Hall, Pl. Tex. 7; Chapm. Fl. ed. 2, 615. *T. angustifolia* and *T. multiflora* Featherman, Bot. Rep. Louisiana Univ. 1870: 73, acc. to Gray, Am. Jour. Sci. III., 2: 375. *Cracca onobrychoides* Kuntze, l. c.; Vail, l. c. 29.—Dry plains, Arkansas, *Nuttall*, *Harvey*, to Louisiana, *Hale*, and Texas.

+ + Petioles longer than the leaflets (rarely equaled by them in *T. Lindheimeri*).

++ Pods 6 to 8.5^{mm} broad: leaflets suborbicular.

T. LINDHEIMERI Gray. Soft-pubescent perennial herb with long reclining branched stems and 5–13-foliolate leaves: leaflets broadly obovate, rounded at the end, subcuneate at the base, soft-sericeous upon the lower surface; linear striate attenuate stipules

very long: flowers rather numerous in erect pedunculate racemes, purple: pods velvety-tomentose.—Pl. Lindh. 2: 172; Torr. Bot. Mex. Bound. 51. *Cracca Lindheimeri* Kuntze, l.c.; Vail, l.c. 28. Sandy prairies, southwestern Texas, *Lindheimer, Wright, Palmer, Havard, Fuchs.* (Adj. Mex. where first collected by *Berlandier.*)

++ ++ Pods about 4^{mm} broad.

T. AMBIGUA Chapm. Stems prostrate or ascending, from a deep woody root, copiously pubescent to nearly glabrous: leaves erect, 3-13-foliolate, petioles 3.8 to 6.3^{cm} long; leaflets obovate to oblong, obtuse or obtusish, 2.5 to 3.8^{cm} long, 6 to 17^{mm} broad, sparingly appressed-pubescent or glabrate above, veins red and surface paler, appressed-pubescent beneath; stipules 4 to 8.5^{mm} in length: peduncles long, ancipital, remotely 3-6-flowered: calyx very small: petals purple: pods narrow, appressed-pubescent, many-seeded.—Fl. 96; Wood, Bot. & Flor. 95. *T. hispidula* var. β Torr. & Gray, Fl. 1: 296. *Galega ambigua* M. A. Curtis, Jour. Bost. Nat. Hist. Soc. 1: 121. *Cracca ambigua* Kuntze, l. c. 174; Vail, l. c. 32.—N. Carolina, *Curtis*, to Florida and Mississippi, *Pollard*; common.

—Var. *gracillima*. Very slender: leaflets lance-linear, acute or acutish, seldom over 4^{mm} in breadth.—*Cracca angustissima* Vail, l. c. 32, not *T. angustissima* Rugel.—Dry pine barrens near Eau Gallie, Indian river, Florida, *A. H. Curtiss*, nos. 584, 5708; fl. July.

* * Flowers smaller; petals 6 to 8.5^{mm} long.

T. PURPUREA Pers. Slender, flexuous, branching from near the base: root long, at first filiform at length lignescent: stem erect or ascending, finely appressed-pubescent: earliest leaves 1-5-foliolate, the later ones 7-19-foliolate: leaflets very variable, oblong, retuse, or in var. *angustissima* (*T. angustissima* Shuttlew.) linear and acute; stipules filiform; flowers small, purple, the lowest pair usually axillary, the others forming a long slender erect raceme: pods spreading or nodding, 4^{mm} broad, appressed-pubescent under a lens, 3-5-seeded.—Syn. 2:

329; Hook f. & Jacks. Ind. Kew. 2: 1045. *T. leptostachya* DC. Prodr. 2: 251. 1825; Chapm. Fl. ed. 2, 616. *T. adscendens* Macfad. Fl. Jam. 257. *T. tenella* Gray, Pl. Wright. 2: 36. *T. angustissima* Shuttlew. in Chapm. 1. c. 96. *Cracca purpurea* L. Spec. 2: 752; Vail, 1. c. 31. *Galega piscatoria* Ait. Kew. 3: 71. —Sandy ridges, Florida, *Rugel*, *Curtiss*, no. 584*, *Garber*, *Simpson*, also from W. Texas, *Havard*, to Arizona. (Tropics of both hemispheres).

GRAY HERBARIUM.